MANPRINT
Newsletter
Fall/Winter 2005

The Director's Corner

In the last two years, MANPRINT and Human Systems Integration have attracted much Congressional attention. The 2005 House Report directed the Department of Defense to produce an overall review of its HSI program. The MANPRINT Directorate has worked with the other Services to produce a report that is winding its way through OSD on its way to Congress. Now the 2006 House Report has asked for an additional system-by-system review of HSI efforts. Also, the National Defense University has been directed to convene a panel to evaluate the contribution of HSI. Our office is very much involved with these activities, and once the reports are accepted by OSD, I will make them public. It is important to note that Congress's interest is in our community's best interest. For several years HSI has received a specific earmark that significantly adds to our budget. I expect that these reports and Panel will set the basis for additional support from Congress in the future. It is good for us to know that our work has attracted high level attention and that our contribution to the nation is appreciated through the provision of additional funds.

We skipped having the traditional MANPRINT display at AUSA-Washington this year, but we still plan to display at the AUSA Winter meeting in Ft. Lauderdale. That meeting has a more distinct acquisition orientation. We are using the funds saved from the Washington meeting to display at smaller, more systems-specific meetings. So far, those meetings have been in the air and missile areas, but if you have recommendations for other meetings, please contact Dr. Knapp. So far, we believe we are getting some real benefits from the smaller meetings.
We are now engaged in planning the next MANPRINT Practitioners' Workshop. It will be held in the Washington area in the May-June period. I have been very pleased by the quality of the presentations and the spirit of community that we have had at previous workshops. We will do everything we can to continue that tradition. Again, if you have recommendations on this issue, please contact Dr. Knapp.

One of the most exciting initiatives in the MANPRINT office is the MANPRINT Enterprise Process Manager (MEPM). It is an enterprise database designed to establish a valid baseline and scorecard of our MANPRINT work. MEPM will help us gain situational awareness of our individual domain products and to determine the range and scope of coverage for the many acquisition systems. The first instantiation of the MEPM is a simple spreadsheet that catalogs where

Michael Drillings
Director for MANPRINT

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Manning Analysis for Army G-1

na Polzin, Sue Archer Micro Analysis & Design, Inc.

Introduction

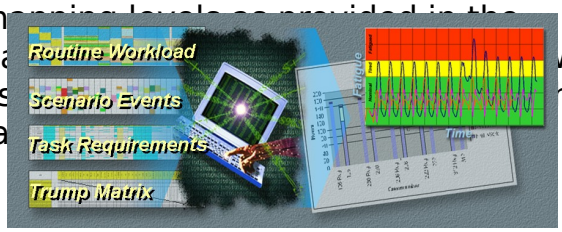
The Army's G-1 office has been charged with evaluating structural organizational alternatives for the Future Force. To perform this task, they have chosen to conduct human performance modeling to assess the workload level within the battalion in the Brigade Combat Team (BCT). The developed model will demonstrate how the changes in manning may affect each person's workload in an operational context where much of the workload is driven by routine, day-to-day task loads and will support quantitative and unambiguous tradeoff analysis of manning levels and task completion rates.

Model

The modeling tool used in this effort simulates manning requirements from a macro perspective to determine the adequacy of a proposed manning level. The simulation considers the combined effects of numbers of Soldiers, routine workday schedules, and any extra duties (guard duty, casualty operations, days off). Simulation results are used to evaluate whether the assigned personnel can successfully accomplish all regular activities and extra duties and do so within acceptable fatigue levels.

Three initial models were developed during this seed project: one each for "Home Station as-is", "Sustained Deployment as-is" and "Conflict as-is" reflecting the workload with the current G-1 structure at Battalion level. Each of the current models represents work during one month's time (31 days). Initially, a set of workload related tasks to be accomplished by the Battalion personnel were identified using the

guard duty or casualty operations. The MOS and numbers of people required and desired to perform the tasks were also necessary inputs. Finally, there is a trump matrix that specifies priorities between combinations of competing tasks. After the simulation runs, outputs are provided that assess the impact of sustained operations. The output includes data indicating whether all tasks were completed given the



Scenario Assumptions

G-1 SMEs provided a schedule and a series of scenarios that would reflect what the soldier does during a one-month period for each model. These scenarios take into consideration the regularly scheduled day, any extra duties the soldier may have as well as days off. The scenario for home station is significantly different from both sustained deployment and conflict, which are fairly similar. For home station, during a one month period, each soldier would stand a 24 hour watch followed by 24 hours off and once a week he would have family time that would enable him to leave work at 1300. Technical/MOS training would occur weekly as well as motor stables once a week for three hours. Manning levels at home station, based on the Battalion workload spreadsheet, would be 3 71Ls, 4 75Bs and 3 75 Hs.

Sustained Deployment and Conflict were quite similar in terms of their extra duties. Each person had guard duty once a month followed by a day off. Several had casualty operations although it was not specified that each person had to perform this duty.

Continued from page 2

working 12-hour days. Sustained deployment manning levels called for 4 71s, 4 75Bs, and 3 75Hs. During conflict, soldiers would be working 14-hour days and the manning levels were lower: 3 71Ls, 3 75Bs, and 2 75Hs.

Results

Figure 1 displays the workload and manning comparison for all conditions.

In home station, the level of manning for each of the MOSs was not sufficient in order for all of the work to be completed: 71Ls had 145.95 hours of work not completed representing 0.83 people, 75Bs had 145.08 hours of work not completed representing 0.82 people, and 75Hs had 91.27 hours of work not completed representing 0.52 people. All extra duties beyond their normal workload such as watch duty, training, and motor stables were completed.

During sustained deployment, manning levels across all MOSs enabled all of the work to be completed during sustained deployment. All extra duties beyond their normal workload such as guard duty, casualty operations and position improvement were completed. This indicates that based on the scenario assumptions stated earlier the manning leve ate the amo

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of the normal work. The inability of the 75Hs to complete all of their work does not come as a complete surprise as the manning numbers as indicated by the Battalion workload spreadsheet was greater than 2 yet less than 2.5 and therefore a manning level of 2 was used. The manning level for both 71L and 75B enabled them to complete all of their work. All extra duties beyond their normal workload such as guard duty, casualty operations and position improvement were completed.

Figure 2 shows a comparison of all the different conditions and the average number of working hours for each MOS. The number of hours worked during conflict is almost double those at home station while sustained deployment averages about 1.5 times the hours of work.

Figure 3 shows average fatigue levels for each MOS under each working condition for the month long scenario. It can be noted that fatigue levels for each of the MOSs at home station and sustained deployment are generally at very low levels. Each MOS experiences normal levels of fatigue 90% of the time. Fatigue levels are a bit higher when soldiers have a 24-hour duty assignment, which happens once a month, but the number of hours each person has to recover from the 24 hours of duty allows the fatigue levels to remain quite low. Soldiers experience bad fatigue (fatigue > 6) less than 2% of the time during home station. Sustained deployment fatigue levels are also primarily at a normal level, roughly 85% of the

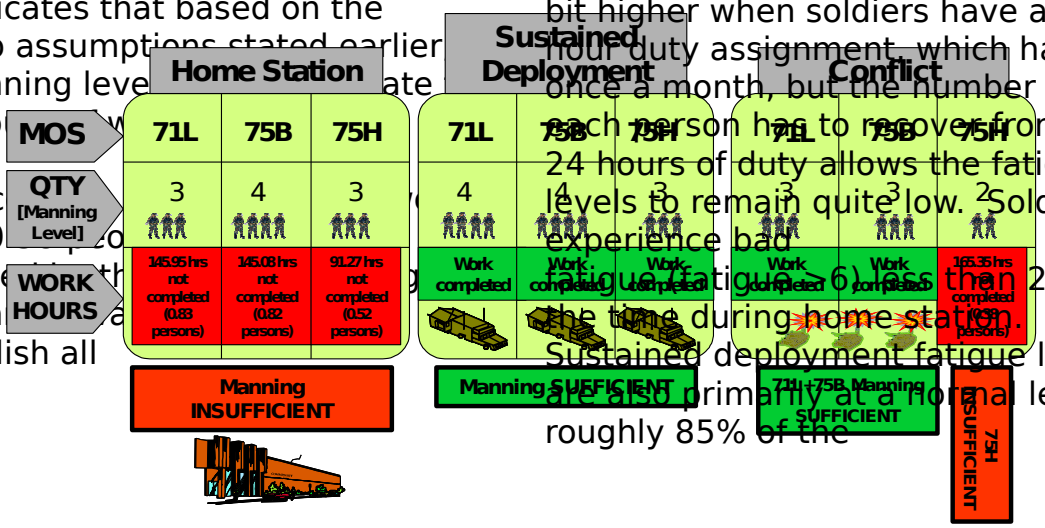

Figure 1. Workload Comparison Between Conditions

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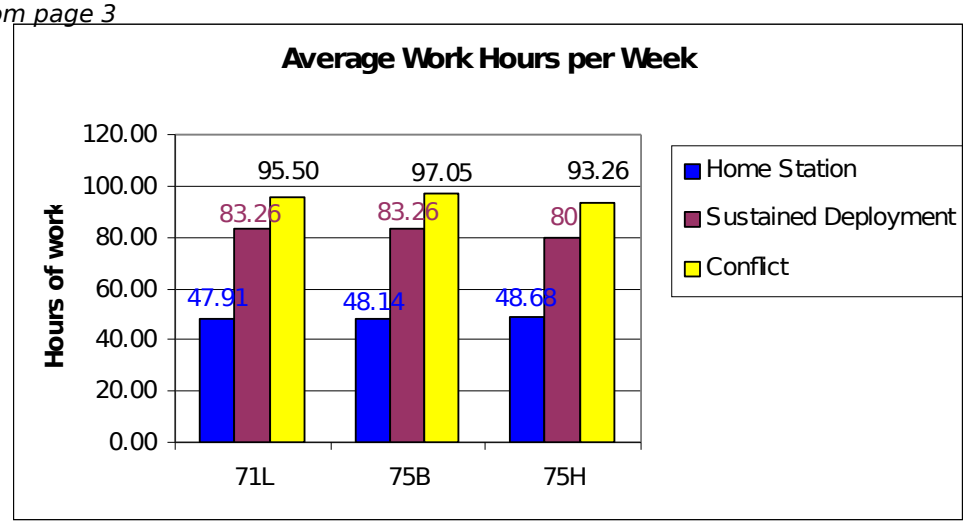


Figure 2. Average Productive Work Hours Across all MOSs for Each

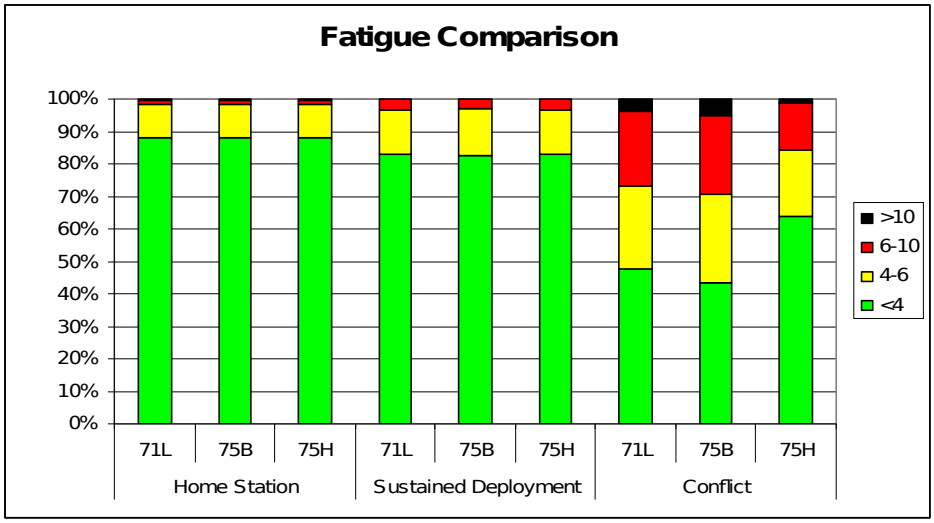


Figure 3. Home Station Fatigue Levels

time. Soldiers experience fatigue levels above 6 about 2-3 percent of the time. 71Ls and 75Bs experience a slightly higher percentage of bad fatigue due to a greater number of working hours over night during casualty duty. During conflict, each MOS experiences a dramatic fall in normal levels of fatigue as well as an increase in fatigue levels over 6. The 71L experience fatigue over 6 about 25% of the time, 75Bs experience it closer to 30% of the time while the 75Hs experience a shorter amount of time under high fatigue, approximately 15% of the time. These numbers indicate that the soldiers are working while very fatigued, especially towards

Summary

The results of this work indicate that the human performance modeling tools do provide interesting capabilities in manning studies of this type. The ability to easily compare results across scenarios and to assess the impact of cumulative fatigue does add value to the analysis. Additionally, the short run times for the model and the ease of data input and modification provide a capability that can be used within the G-1 organization if desired.

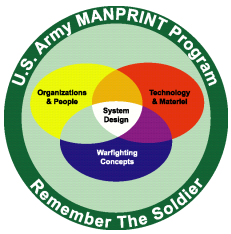
Currently, this model is being used to determine the workload and fatigue levels at the Brigade level as well as in a Garrison detachment that remains at base while the unit is deployed. The

Meetings of Interest

AUSA Winter Symposium and Exhibition
February 15-17
Broward County Convention Center
Fort Lauderdale, Florida

AAAA Annual Convention
9 - 12 April 2006
ord Opryland Convention Center
Nashville, Tennessee

MANPRINT Workshop
Coming Spring 2006



Space and Missile Defense Conference and Exhibition
Summer 2006

49th Annual Meeting of the Human Factors and Ergonomics Society (HFES) 26-30 Sep 05

Dr. Bev Knapp, G-1 MANPRINT Office

Members of the G-1 MANPRINT Office attended the 49th Annual Meeting of the Human Factors and Ergonomics Society (HFES) 26-30 Sep 05. The overall HFES purpose was to bring together researchers and developers in the area of human-system processes and design. From the MANPRINT perspective, the priority meeting objectives were to: ensure that HFE research is on target to address applied systems areas, facilitate collaboration among government, industry, and academic organizations and their proponent sponsors, and to educate researchers about government/industry base needs. Over 100 technical presentations, panels, and demonstration sessions were provided in 22 subject areas. MANPRINT efforts were evident in many sessions, especially those sponsored by the System Development, Cognitive Engineering and Decision Making, Human Performance Modeling, Communications, Computer Systems, Safety, Test and Evaluation, Training, and Virtual Environments technical groups.

MANPRINT's deputy director participated in a panel session called "Expanding DoD Human Systems-Integration (HSI) Demands: Can we deliver what is

This session addressed the impact of the new, recently published DoD Instruction 5000.2 (only available on-line at http://www.dtic.mil/whs/directives/corres/html/50002.htm), which directly mandates that Human Systems Integration (HSI) become a focus for all new system acquisitions. In the Instruction, HSI is defined to include: Human Factors Engineering, Personnel, Habitability, Manpower, Training, Environment, Safety and Occupational Health (ESOH), and Survivability. The new acquisition policy intends that each of these HSI areas become a documented component of all acquisitions to meet maximal capability with the right number of personnel, suitably trained and at the same time assuring their health, safety and survivability. Panel goals were to inform the community of the expanded DoD HSI emphasis and ask the HSI community to assess whether and how we are situated to meet the demands.

Each service representative presented a short brief on their HSI enterprise and the impact of the DoD Instruction on their acquisitions, including what works well and what difficulties are faced. The university experts presented their perspective on the state of academics to provide a basis for suggesting new research directions, developing HSI curriculum, and recruiting strategies for HSI practitioners. There was extensive audience

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Gunslinger User Interface Development

Jessica L. Munch and L. Dawn Janssen

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INTRODUCTION

Background

The Gunslinger System is being developed as a technology demonstration, using an evolutionary systems design strategy, namely spiral development. As a part of spiral development, design is iterative; requirements are refined via demonstrations, risk management and continuous user feedback. Future increment requirements depend on user feedback and technology maturation (DoD 5000.2, 2003). The Spiral One Gunslinger System is a mobile (but not on-the-move), two-man system that is designed to enhance a United States Marine's ability to detect, locate, and return fire when hostile fire has occurred. Benefits of such a system include increased situational awareness and decreased response time when locating and targeting hostile fire. The Spiral One system integrates the following component technologies into a standard S-788/G High Mobility Multi-Wheeled Vehicle (HMMWV) shelter:

- MK 45 MOD 0 Weapon System, with M240G Machine Gun
- Small Tactical Arms Recognition Equipment (STARE) IR Sensor System
- Tetrahedral Projectile Detection and Cueing (PDCue) Acoustic Sensor Array

Although the Spiral One system can only be operated while the vehicle is stationary, the component systems are mounted on a hydraulic platform that can be lowered into the vehicle shelter and safely stowed while the vehicle is on the move. Once inside, the sensors

elevation, and range. Tetrahedral PDCue can present several different types of fire events depending on the information received by the sensors (complete and ambiguous solutions). STARE is also able to differentiate between large and small arms fire. These integrated coordinates and the appropriate fire event information are displayed, relative to the vehicle shelter, on the Gunslinger graphical user interface (GUI). The GUI provides operators with a visual representation of the HMMWV and any surrounding detections, and allows operators to perform a number of tasks. These tasks include: slewing and tilting the STARE IR sensor, slewing the MK 45 weapon system, filtering or zooming the target view, and obtaining information about each detected event.

The optic systems on either the STARE sensor or the MK 45 weapon system may be used to obtain visual confirmation of a fire event source. At this point, Gunslinger provides operators with a variety of capabilities.

For example, the operator may choose to return fire using the MK 45 weapon system, or to call for support (relaying the target information presented on the interface). Additionally, once visual confirmation is attained, the operator may decide that the target is not of interest and may clear it from the interface. For safety certification reasons, the Spiral One system capability is limited to the identification and prioritization of targets; actually engaging a target is only possible via the MK 45 display and controls.

Purpose

One of the most important aspects of designing an effective human-machine interface is consideration of the user

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(DoD 5000.2, 2003). Poorly designed human-machine interfaces have been the cause of many catastrophic accidents. For example, the meltdown at Three Mile Island was attributed to a user interface that did not accurately represent the status of the plant (NPP Operation Safety, 2004). Inconsistent layout of controls had disastrous effects when the P-47 Thunderbolt fighter plane's cockpit was redesigned in the midst of World War II; in this case, pilots became confused between the old and new designs (Casey, 1993).

As engineering psychologists and human factors engineers have since discovered, these accidents might have been avoided by designing interfaces using good design principles, such as providing "visibility of system status" and "consistency and standards" (Nielsen & Mack, 1994). The application of these principles in the design of the Gunslinger GUI was critical, for similar reasons.

Gunslinger operators will be working in a high-stress and time-critical operational environment, where precise and accurate actions are necessary to successfully complete a mission, or in some cases, to stay alive. Operators working in such environments have minimal time to interpret ambiguous displays or to determine how to take desired actions; efficient and intuitive designs that can aid the decision-making process are crucial. For these reasons, it was especially important to the Gunslinger program that the interface design approach was based on a solid human factors design and evaluation process. The purpose of this paper is to discuss the human systems integration (HSI) approach taken and its effect on the iterative process of interface design.

issues of high workload and user error. The level of effort provided by HSI personnel averaged roughly one-half man-year, and was highly dependent on program need. During GUI testing and evaluation activities, up to four HSI personnel were involved; throughout other phases, little or no support was required.

The Usability Engineering Lifecycle

A modified usability engineering lifecycle process (Mayhew, 2004) was applied to the design of the Gunslinger GUI. The process is somewhat flexible, as modifications of the lifecycle can be made to accommodate each program's specific development schedule by varying the techniques used at each stage. One of the benefits of employing a usability engineering lifecycle is that its iterative process naturally lends itself to GUI design within the DoD acquisition process. For example, in a spiral development, design iterations occur within a spiral to provide each deliverable. Additionally, the final interface from one spiral, along with new capabilities and requirements, can be consolidated into the first iteration of the next spiral.

This early involvement allowed the usability specialists to incorporate user and environmental characteristics, a breakdown of required user tasks, capabilities and constraints of multiple component systems, and general human factors design principles and standards into usability goals. These goals were then translated into a conceptual GUI. For the Gunslinger project, no style guide was required, and the main goal was to create an effective user interface with quick turn-around time. Given some of the constraints of the program, no formal usability testing was conducted.

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variety of inspection methods that can be used, often in combination, to distill potential usability concerns. Some of these techniques include: heuristic evaluations, focus groups, co-discovery, field observation, think aloud protocols, consistency inspections and cognitive walkthroughs (Mayhew, 2004; Nielsen, 2003; Nielsen & Mack, 1994).

Cognitive walkthroughs, heuristic evaluations, co-discovery, and focus groups were found to be most useful in the iterative designs of the Gunslinger GUI. In cognitive walkthroughs, an individual analyst looks for usability successes and failures of the team's design by putting him or herself in the shoes of the operator. By simulating a user's problem-solving process and walking through each step in a task scenario using the GUI, it was possible to identify potential mistakes and consider how a redesign might impact the user's interaction with the interface (Mayhew, 2004). Cognitive walkthroughs were used between each design-iteration.

Heuristic evaluations are based on ten general principles for user interface design, developed by Jakob Nielsen (Nielsen & Mack, 1994). Examples of some of these principles include "visibility of system status", "consistency and standards," and "recognition rather than recall". Oftentimes, cognitive walkthroughs and heuristic evaluations are done concurrently. Concerns found by a usability specialist as he or she walks through a task scenario are expressed as violations of one or more of these ten principles, and are accompanied by a design recommendation.

Although cognitive walkthroughs and

representing a wide range of military experience (i.e., enlisted personnel, officers, and warrant officers). To obtain feedback from representative end users, usability sessions with these subject matter experts (SMEs) were developed around a combined co-discovery / focus group approach.

During a co-discovery session, participants try to perform tasks in a group while being observed by the system designer (Hom, 1996). This approach is slightly different than a think-aloud protocol in that participants are encouraged to talk to other participants to help themselves accomplish the task; this situation is more representative of the real world. It also allows some ideas which one participant may not have come up with alone, to surface through interaction with other participants. This method was ideal for the Gunslinger users since the system is to be used in a team environment. Another similar method of eliciting information is through the use of a focus group (Diamond Bullet, 2004). Here, usability experts talk to a group of SMEs at one time, allowing them to discuss issues that are of importance to them, and to come to a consensus on a particular topic.

Results

The Spiral One Gunslinger GUI progressed through several iterations before reaching its final state. The following sections describe the development in detail, and provide an explanation of the application of each inspection technique.

ITERATION ONE – PRELIMINARY DESIGN

After being given a quick summary of user needs, compon

Continued from page 10

users are required to determine what information is truly needed or important), ensure that the Gunslinger GUI is consistent with other component displays, determine which functions should be allocated to the operator, and to design to prevent errors. The preliminary cut of the GUI is shown in Figure 1. In the earlier iterations, Boomerang was the acoustic detection sys
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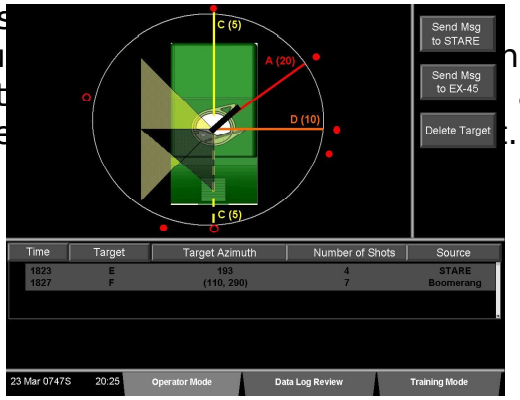

Figure 1. Preliminary cut of GUI.

ITERATION TWO – COGNITIVE WALKTHROUGH AND HEURISTIC INPUT

For the next design iteration, usability specialists employed a heuristic evaluation. During this step, the preliminary cut of the GUI was vetted by a larger group of usability specialists. This evaluation used a cognitive walkthrough approach to ensure that Nielsen's ten usability heuristics (Nielsen & Mack, 1994) were not violated.

Several design changes were made as a result. For example, the source of the detection was combined with the target number (e.g. S001 or B001 to designate a STARE or a Boomerang detection, respectively), allowing the operator to determine at a glance which system detected the event (supporting Nielsen's "visibility of

("aesthetic and minimalist design"). The resulting GUI incorporating all of these changes is shown in Figure 2.

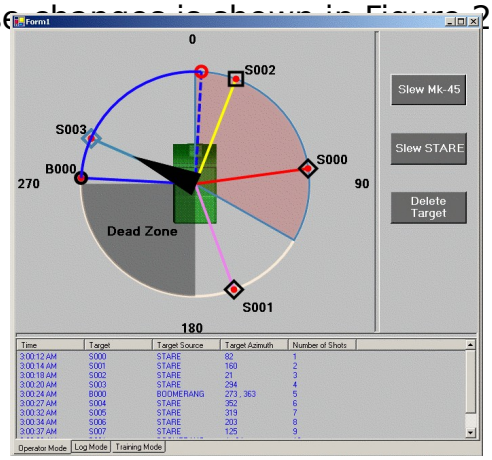

Figure 2. GUI following heuristic review.

At this stage, feedback from the end users of the system had not yet been solicited; however, the quick heuristic review resulted in several design changes. Inserting a heuristic review into the process before taking the design to the SMEs saved valuable resources. By eliminating the more glaring usability issues prior to user sessions, usability specialists allowed SMEs to focus more on providing domain-specific feedback. The cognitive walkthrough process also helped identify additional domain-specific questions. Based on a question about what information is important to users in prioritizing targets, another interfe sent to enc assum exper would aware tors, and a ts. This a Figure

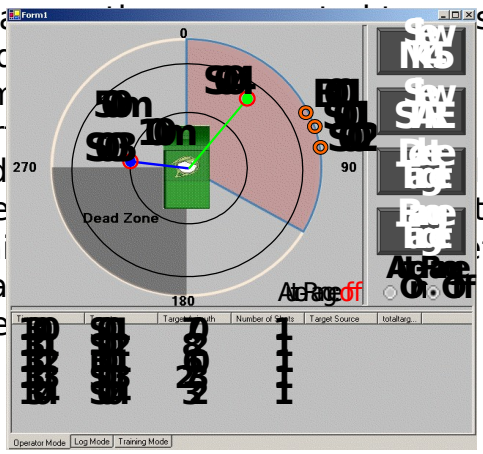

Figure 3. GUI with representation of target range inform

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ITERATION THREE – END USER INPUT

At this point of the Gunslinger GUI design, it was crucial to present the GUI ideas and prototypes to potential end users (subject matter experts), to elicit domain-specific feedback. Seven Marines, representing enlisted personnel, warrant officers, and officers, were invited to attend a warfighter conference. At this gathering, all aspects of the Gunslinger system were vetted by these domain SMEs.

To evaluate the proposed GUIs (refer to Figures 2 and 3 above), a simulation was developed, and the Marines were instructed to proceed through a scripted scenario. The scenario was written to provide the Marines with the opportunity to interact with each aspect of the GUI, and to allow them to discover how each particular task could be accomplished. During the session, other Marines, usability experts (the session facilitators), and software engineers looked on and answered questions. This allowed for co-discovery. Verbalized interactions, questions, and suggestions were observed and recorded by the usability experts. Concurrent with the co-discovery learning, the Marines also participated in conversations that more closely resembled a focus group session. The usability specialists had several questions that required input from the end users; as a group, the Marines discussed their preferences and what they felt were the most important issues, and they provided suggestions for future design iterations. As one final way to elicit information, questionnaires were distributed to the Marines. In addition to soliciting general feedback about the GUI, the questionnaires also

1. *Range rings*: Warfighters use range as one of the primary means for prioritizing targets, so the range rings were considered helpful. Reasonable ranges and representation of unknown ranges were also discussed.
2. *Standard military symbology*: The symbology that was used was unfamiliar (some Marines are unfamiliar with STARE); the warfighters suggested using standard symbology that would be more easily recognizable (FM101-5, 1997; MIL STD 2525A, 1996). They also felt that the lines connecting targets to the vehicle cluttered the display, and the colors were unnecessary.
3. *Filtering*: The warfighters would like the ability to filter the display by certain types of fire events; this would also help with prioritization.
4. *Compass and vehicle heading/location*: Warfighters had differing opinions on how to represent vehicle heading and target azimuth (e.g., the clock reference is used within a convoy and the compass azimuth (degrees) is used to communicate with outsiders).
5. *Undeleting targets*: There should be a way to undelete a target that has been deleted.
6. *Easy slew capability*: Warfighters desired the ability to slew the MK45 and STARE to the same position simultaneously.
7. *Target log*: The warfighters felt that the target log was valuable, but was not needed on the screen at all times. The ability to sort the log was also requested, which would help in target prioritization.
8. *Touch screen or voice input*:

Continued from page 12

The warfighter comments were divided into two categories: potential near-term fixes that would be attempted in Spiral One (issues 1 through 7) or potential future implementations to be addressed in upcoming spirals (issues 8 and 9). The GUI developed by consolidating the information gathered at the warfighter conference is shown in Figure 4. Updates were also made b… s… T…

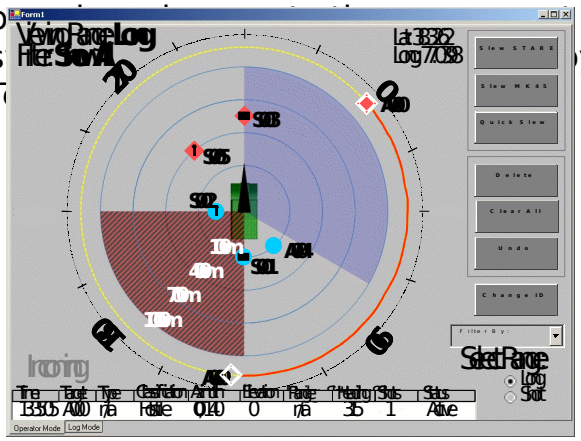

Figure 4. GUI based on end user input.

ITERATION FOUR – FINAL GUI

After making design changes based on warfighter feedback, the next step was to obtain programmatic feedback through a design review. This experience served as a reminder that constraints of policy and doctrine are absolutely critical when dealing with military systems. In the previous iteration, symbols consistent with MIL-STD 2525A and FM101-5 were implemented; and as a part of this implementation color-coding made it possible to designate fire events as friendly (blue), unknown (yellow), or hostile (red). Although this addressed multiple issues raised by the warfighters, it was found to be in direct conflict with strict DoD requirements for classification of contacts/tracks as "Friendly", "Unknown", or "Hostile"

that have been addressed (See Figure 5). This function allows the warfighters to designate some targets as being of less importance (addressed) than others at the moment. This offers a different capability than simply deleting a fire event; the warfighter can leave this fire event on the screen, knowing that he may want to return to it at a later time.

Another challenge that was faced, throughout iterations three and four, was the designation of direction on the compass ring. Although it seemed straightforward, there are many options for displaying direction, including clock positions (12, 3, 6, and 9), cardinal directions (N, S, E, W), and degrees (0, 90, 180, 270). Operational scenarios and personal preferences seemed to influence warfighter suggestions, but no display solution appeared to be optimal in all scenarios. Designers considered providing options, so that the warfighters could customize the direction display on their interface, but this was ruled out based on the critical need for consistency in communications, within and outside of the Gunslinger System. The decision to keep degrees was based on the assumption that clock positions and cardinal directions may be more intuitive than degrees (and might therefore be more easily estimated without visual cues). If degrees were required for call-for-fire communications, an interface providing these less intuitive cues might be useful. As a part of the iterative process, designers are always looking to better represent the data; therefore, this design element may change in future spirals based on additional feedback from field users.

Several other functions were added to

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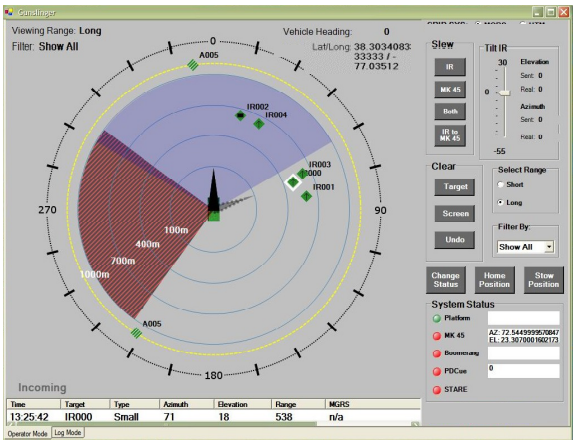

Figure 5. Final Spiral One Gunslinger GUI.

ADDITIONAL HSI IMPACTS

Interior Vehicle Layout

Although it is not the focus of this paper, the HSI group also contributed to other portions of system design, including the internal vehicle layout. Space was a severely limiting factor, which drove many of the layout decisions; but human factors engineers provided feedback on optimal configurations for seating, table space, monitor arrangement, and hardware input devices (joysticks, keyboards, etc).

Operator's Manual, Training and Troubleshooting

Operator's manuals and training are not traditionally within the scope of human factors tasking; however, the DoD acquisition process has identified seven key elements of Human Systems Integration, including manpower, personnel, *training*, safety, human factors, health hazards, and survivability. As programs such as Gunslinger work to address all of these elements, human factors engineers are called upon to provide insight into training and troubleshooting, based on their experiences working with and designing for the end user. For Gunslinger Spiral One, the HSI group helped organize and write the operator's manual, and coordinated

effort. In Spiral Two, the system will evolve from a mobile system (the vehicle can move, but the Gunslinger system may only function while the vehicle is stationary) to an on-the-move system (detection and engagement may occur while the vehicle is moving). This new requirement will cause a significant redesign of the GUI, mainly in terms of target representation and tracking. Again, end user input is crucial in determining how the system will be used when on the move (suppression or survival) and what information is important to the warfighter to achieve these goals. Other impacts on HSI in future spirals include changes in interior layout due to choice of vehicle, and in terms of control issues when the system becomes 'unmanned'.

CONCLUSIONS

In hindsight we can look back at the evolution of GUIs and recognize the significant problems that might have arisen out of the first or second iteration. For example, without range rings warfighters may not have had the information they needed to prioritize the fire events. Other design changes that were made could potentially mean the difference between life and death - the quick slew capability, for example, may shave critical seconds off of a detect-and-engage sequence. By implementing standard symbology we may have reduced training requirements. Additionally, since this symbology is more familiar than the STARE symbology, and has likely been trained to the point of automaticity (Perry, 1999), the new symbols may even promote faster recognition and reaction under stress.

Human performance measurement could allow us to quantify these

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specifically quantifying these improvements may not be possible – money and time may be better spent elsewhere. The opportunity to make a substantial impact on design should not be passed up simply because the ideal solution (the implementation of complete human factors experiments) is not attainable due to time and funding constraints.

In the current state of DoD acquisition, there has been a significant movement to consider the human during system design. PMs are being strongly encouraged to include human systems integration activities in their budgets and schedules; however, many are hesitant to do so. Most would not argue (in principle) with the need for HSI, but many are unfamiliar with the specific contributions that HSI can bring to a program. The terminology and processes may also be unfamiliar, and realistically, many PMs have managed "successful" programs in the past without it. Before this revolution in the acquisition process, human performance was not traditionally a system metric, and wasn't in the scope of a PM's responsibility. As human factors and usability engineers in the acquisition process, we recognize our commitment to the end user (the warfighter). As an HSI community, we must also recognize that we have a responsibility to PMs and the acquisition community to understand and work within the constraints of these programs. This paper has attempted to close the gap by providing an example, including a brief explanation of how some human factors and usability processes fit within the context of an acquisition program.

The success seen to date on the programs to make a difference to our customer – the warfighter.

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Nuclear Power Plant Operation Safety

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- At "Test and Evaluation Days", Von Braun Center, Huntsville, Alabama, (7-9 June 05) the MANPRINT Directorate and a representative from ARL-HRED staffed the MANPRINT booth and had significant activity with both the test and acquisition community. Mr. Walt Hollis (DUSA-OR) spent considerable time visiting our booth.

- At the Army Aviation Association Unmanned Aerial Vehicle Conference, Marriott Crystal Gateway, Arlington, Virginia, (24-26 October 05) the MANPRINT Directorate and a representatives from ARL-HRED staffed the MANPRINT booth and drew considerable interest and questions from the UAV industry representatives. GEN Cody (VCSA) visited our booth and stated his appreciation for the presence of MANPRINT at the conference.

- The MANPRINT Directorate welcomes current MANPRINT-related news, information, and articles to use for publication in our

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